

A GENERAL SHOP BASED UPON THE COMMUNITY NEEDS
FOR THE CITY OF LYONS

by

JOHN WILLARD TRUAX

B. S., Kansas State College of Agriculture
and Applied Science, 1929

A THESIS

submitted in partial fulfillment of the

requirements for the degree of

MASTER OF SCIENCE

Department of Education

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1941

4 1357 v. 1

Docu-
ment
LD
2668
T4
1941
T71
C.2

TABLE OF CONTENTS

INTRODUCTION	1
METHOD	2
SHORT REVIEWS OF OTHER STUDIES IN THIS FIELD	3
PRESENTATION AND INTERPRETATION OF FINDINGS	8
STUDY OF SIXTEEN KANSAS HIGH SCHOOLS.....	11
CURRICULUM FOR A GENERAL SHOP FOR LYONS	20
PROPOSED EQUIPMENT AND ITS COST	21
CONCLUSIONS	54
ACKNOWLEDGMENT	35
LITERATURE CITED	36
APPENDIX	37

INTRODUCTION

Great national emergencies bring to the attention of the leaders of the nation the inadequacy of the program of education to meet the needs of all the people. The high schools have given major emphasis to the type of education the colleges and universities require for entrance to their curricula. In the average small city of 5,000 or less in population, little or nothing has been done in the high school to educate and train the boys to enter the trades and industries of the community in which the high school is located.

The present national defense program has brought to the attention of the nation the shortage of trained workers in all the defense industries. These industries have taken from the communities a large per cent of their inadequate supply of trained workers.

The leaders of the public high schools are beginning to recognize this weakness in the types of work they are offering. In the high school of Lyons, Kansas, it has been recognized that the types of work offered in the industrial arts shop did not meet the needs of all the boys who would make their life work the trades and industries of the community. In order to adapt the work in this shop to the needs of the trades and industries in Lyons, it was decided to determine what these needs are and to organize a general shop in which to teach and practice the underlying principles and skills that are employed

in carrying on these trades and industries.

The city of Lyons is the county seat of Rice County, which is located in the central part of the state of Kansas. It has a population of 4,500. Primarily an agricultural community, it is surrounded by the central Kansas oil and gas fields. Two large salt mines are located on either side. It has ten garages, three electric shops, two newspapers, two welding shops, five plumbing shops, and carpenter contractors. These industries require trained workers in practically all of the skills.

A review of other studies is included in order to show some of the previous studies made in this field. This study was made to benefit Lyons and also to help introduce general shops in other high schools of comparable size. Previous studies show that this work is universally needed (2) (11).

METHOD

In order to organize the curriculum for the general shop it was necessary to know what the information, principles, and skills a worker in a particular trade or industry should have in order to be proficient in his job. It was decided that the best way to collect these data was to make a survey of the trades and industries of Lyons, general shops in high schools with about the same enrollment, and the necessary machines and tools.

This survey, which includes studies of four different types, was made by means of questionnaires and personal interviews. In the first study information was secured from contractors, owners or foremen who were interviewed in order to find the number of

men employed, their average salaries, the number of hours per day, and the number of hours per week they are employed. The trades used in this survey are carpentry, mechanics, machine shop, electricity, plumbing, masonry, printing, and salt mining.

In the second study the skilled and semi-skilled tradesmen were interviewed to find which subjects now offered in high schools they considered most important and useful in the light of their present experience and knowledge.

In the third study sixteen Kansas high schools of comparable size to Lyons, which is a four-year high school with 350 pupils enrolled, were surveyed as to their equipment, units taught, units that should be taught, present size of classes, and desired size of classes.

In the fourth study the names, descriptions, and costs of the minimum of equipment for a general shop accomodating a class of 24 students was secured from the manufacturers.

The data secured in these surveys were organized into an integrated curriculum. The author believes this curriculum meets the needs of this particular high school and community.

SHORT REVIEWS OF OTHER STUDIES IN THIS FIELD

A curriculum should include vocational education, or the cultivation of the skills and techniques of operations necessary in the trades and professions. General education and vocational education will not conflict but will be a benefit to each other if properly organized (5).

Only about 15 per cent of our youth go on to college, while

one-third find work in the industrial arts field. Any training for life's work that these workers receive must be in the secondary schools. One way to accomplish this is by means of a general shop program (2).

In a study in several states of subject matter for the general shop (11), the teaching of four units in the same period was the most popular. Thirty-seven per cent of the shops were overcrowded. Twenty-four seemed to be the desired number for a class. The time allotted in most schools was 250 to 300 minutes each week. Ninety-seven per cent of the schools reported a shop library. Forty-three per cent favored a general shop where there was just one teacher.

This report shows as high as 24 different units taught, which are, in order of their popularity, woodworking, in 81 per cent of the schools; drawing in 61 per cent; electricity in 55 per cent; sheet metal in 55 per cent; and in descending order, general metal work, foundry, machine shop, forging, cement, and concrete, art metal, automechanics, arc-welding, home mechanics, wood turning, and electric and acetylene welding. In the changes that have taken place woodworking has been dropped most frequently.

The advantages brought out for general shop are (a) greater variety of industrial, manipulation, and construction experiences for the pupil; (b) greater opportunity for guidance or finding course; (c) greater economy, lower per capita cost, and (d) more interesting to the pupil.

There are two outstanding disadvantages of the general shop.

The instruction problem is more difficult and complicated, and adequately prepared teachers are harder to find (11).

Feuerstein (3) made two surveys, one in 1927 with 32 schools responding and the second in 1935 with 25 of the same schools replying. The summary of the first survey showed that the schools were practically unanimous in agreement, one dissenting, that industrial arts and general shop work were increasing as a part of the educational program. There was no uniformly accepted plan for the industrial arts program, but the old time woodworking course was already beginning to give way to a program of diversified general shop work.

Feuerstein's summary for 1935 substantiated and carried further the 1927 summary, with the emphasis on a more general diversity of work carried on or a general shop. In fact the general shop as such was not reported in 1927, whereas six were reported in 1935. A new question was added in 1935, namely, "What do you consider particularly significant about industrial arts in relation to present day problems?" The most common answer was: "Industrial arts teaches or gives the boy some training in how to make a living and helps him find himself after he is out of school."

Friese (4) of Pennsylvania State College made such statements as "Learning and developmental experiences in industrial arts, through types of experiences not otherwise available, are essential in the complete social education of every boy in a dominately industrial democracy" and "The industrial arts constitute a group of school experiences which embrace the most

fundamental procedure in education; namely, learning through a combination of seeing, hearing, thinking, and doing."

These statements along with many more brought out the need of industrial arts through the general shop which is spoken of as the "new education".

Moffett (8) brought out strong arguments for this new education where schools are being consolidated and industrial arts is given a place in the curriculum. When the units taught fit the community needs in many places, there are requests for night schools so adults can get some of this "new education".

According to Schweickhard (10) in almost any field of endeavor the realities must take the form of specific knowledge and skills. These skills vary from skill in the use of ideas to skill in the use of tools and machinery. In the new year just opening there will be greater demand than ever before for the use of these two realities and the rewards will come to those who possess them.

Bernbaum (1) checked the statement that the industrial arts courses should be the integrating factor of our school curriculum and found that with proper organization and procedure they, by sheer merit, became just that.

Klehm (6) substantiated the already discussed thought of the new education in which we are to educate the student to live, through the industrial arts and vocational training in the high school since most of the students finish their schooling in the secondary schools.

Lush (7) brought out the changing concepts of industrial arts. In early education there was but one unit, where now

there are many, taught at the same time. This is called general shop. One of his main points was the making of the school shop space more productive by continued use. He found this type of shop was best for one-teacher small schools.

As a final reference Reagh (9) presented reasons which should influence teachers of industrial arts (general shop) and vocational education to study conditions so that their educational offerings might fit present day conditions more closely. The principal reasons were (a) the increasing importance of trades in industry; (b) the increase of high school enrollment; (c) the fact that most students end their schooling in the secondary schools; and (d) the fact that 80 per cent of people live and die in the same or similar communities as those in which they grew up. He asks the questions: "Are our courses fitting in this new curriculum?" "Are we teaching to fit the community needs?"

The information contained in the review of literature is evidence that the general shop problem is an important unit in our educational program. It is the duty of the high school to serve the public by training for better citizenship. Better citizenship comes to a community or a nation when its people are gainfully employed.

PRESENTATION AND INTERPRETATION OF FINDINGS

The first group studied was the contractors and shop owners or foremen. This study was necessary in order to determine how many skilled and semi-skilled tradesmen there are in Lyons, the average number of hours per day they work, the average number of days per week they are employed, and the average salaries paid. This was done by means of Questionnaire A (appendix, p. 37) and interviews.

Table 1. Distribution of tradesmen, their salaries, and their working hours.

Trade	Per cent of tradesmen	Average salary	Length of day	Length of week
Mechanics	33	\$27.50	10 hours	6 days
Plumbing	7	\$25.00	9 hours	6 days
Salt mining	25	60¢ per hour		40 hours
Electricity	5	\$28.00	10 hours	6 days
Carpentry	20	60¢ per hour	8 hours	200 days, year
Welding	5	\$30.00	9 hours	6 days
Printing	5	\$32.00		40 hours

The results are given in Table 1 which shows that of the 100 skilled and semi-skilled tradesmen found in Lyons, 33 per cent are working in the garages ten hours a day, six days a week for an average weekly salary of \$27.50.

Twenty-five per cent, mainly representative of the metal trades, are hired by the two salt plants. These tradesmen are governed by government and union regulations, which require a forty-hour week at an average salary of 60¢ per hour.

Twenty per cent of these skilled and semi-skilled tradesmen are employed in carpentry at an average salary of 60¢ per hour, an eight-hour day, and approximately 200 working days per year.

The remaining 22 per cent are made up of printers' helpers, welders (exclusive), plumbers, and electricians. The average salary of these tradesmen is \$30.00 per week with a 40-hour week, where there are enough men employed to come under government regulations. Where fewer are employed they work on an average of nine hours per day and six days per week unless they are on special jobs.

Table 1 also shows that welding and printing have higher average salaries. This is due to the fact that they require a higher grade of skill and longer apprentice periods.

Through the interviews it was learned that the highest salaried trade is that of the automobile body and fender man. These men often receive a salary as high as \$500.00 per month, with an average of \$60.00 per week. This trade is carried on in the garages of the smaller towns; consequently, it has not been shown as a separate trade in Questionnaire A and Table 1.

The results of Questionnaire A as shown in Table 1 indicate that the high school should teach several trades rather than one or two as has done in the past. They also furnish evidence that the average salaries of tradesmen are sufficient for a living wage in a town the size of Lyons.

The second group studied is the skilled and semi-skilled tradesmen. This information is necessary to learn what the men

in the field think they need most in order to become more efficient in their trades. Each tradesman was handed Questionnaire B (appendix, p. 38) and asked to rate the subjects listed in order of preference in the light of his experience and present day knowledge.

Table 2. General shop subjects ranked in order of preference by 100 tradesmen of Lyons.

Trade	Ranking in order of preference
Auto mechanics	1
Oxy-acetylene welding	2
Carpentry	3
Electric welding	4
Woodworking	5
Electricity	6
Woodturning	7
Sheet metal	8
Machine tool work	9
Mechanical drawing	10
Cabinet making	11
Wood and metal finishing	12
Forging	13
Concrete and cement	14
Metallurgy	15

Table 2 shows that auto mechanics was ranked first by the 100 tradesmen of Lyons. Oxy-acetylene welding, which is so closely related to all mechanical work in the modern garage, was ranked second.

Woodworking of different kinds came third. This indicates that manual training still has an important place in our high schools and perhaps should be given greater emphasis than the findings indicate, since every home has woodwork repairing to be done. Manual training does not require the outlay and expense

of equipment that some other trades require.

This study furnishes evidence that these tradesmen think that there is need of more training in a larger variety of trades and that this training should come through the high school.

STUDY OF SIXTEEN KANSAS HIGH SCHOOLS

Another field that was studied is the general shops of 16 Kansas high schools. Eight of these high schools were studied by means of Questionnaires C and D and the other eight by personal interviews in addition to Questionnaires C and D. This study was divided into two parts. The first part was to determine the present and preferred size of classes, the number of industrial arts units now being taught in one period, the number preferred to be taught in one period, the total number of units that are being taught in the different high schools, and the units that the instructors think should be added to the curriculum.

Questionnaire C (appendix, p. 39) was used to secure the data for part one of this study.

Table 3 indicates that the majority of the instructors of the 16 Kansas high schools think the most efficient size of class is from 17 to 24 pupils.

Table 3. Present and preferred size of classes in sixteen Kansas high schools of approximately 400 enrollment.

Size of classes	Number of schools teaching classes with 8-12 pupils or more	Number of schools pre- ferring classes with 8-12 pupils or more
8-12 pupils	2	2
13-16 "	2	2
17-20 "	4	6
21-24 "	4	5
25-28 "	0	0
29-32 "	3	1
33-36 "	1	0

Table 4. Present and preferred number of units taught in one period by 16 Kansas high schools of approximately 400 enrollment.

Number of industrial arts units taught in one period	Number of schools teaching one or more units	Number of schools preferring to teach one or more units
1	3	1
2	5	1
3	4	1
4	1	6
5	0	3
6	1	3
7	1	0
8	1	1

Table 4 shows that at the present time there are from one to eight units being taught per class period. It indicates that for the most efficient classwork the number of units taught per period should be from four to six.

Table 5 shows that woodturning, carpentry, cabinet making, and wood and metal finishing are still the leading units taught in the industrial arts program in the high schools of Kansas.

It also indicates that the greatest need is for more metal work with welding leading the list and sheet metal a close second. It is of interest to note that at least 25 per cent of the schools are now teaching welding. It was learned through the interviews that most of the schools have been teaching welding for one or two years only.

Table 5. Trades being taught and additional ones desired.

Trade	Number of schools now teaching trades	Number of schools that think trades should be taught
Wood and metal finishing	8	0
Woodturning	9	0
Carpentry	1	3
Cabinet making	7	0
Woodworking	10	0
Oxy-acetylene welding	4	6
Electric welding	3	3
Sheet metal	7	5
Forging	6	2
Concrete and cement	2	4
Auto mechanics	3	3
Electricity	6	2
Metallurgy	2	2
Machine tool work	5	3
Mechanical drawing	9	0
Machine drawing	5	0

One difference that may be noted between Table 2 and Table 5 is that the tradesmen listed auto mechanics as their first choice, whereas the instructors gave it fourth place.

The purpose of the second part of this study was to secure information in regard to the equipment of the general shops, the tools and machines that are now in use and the additional tools and machines that are needed.

Carpentry and cabinet making of Table 5 have been omitted from Questionnaire D and Table 6 because they use the same tools that the other woodworking classes have.

Questionnaire D was used to secure these data.

Questionnaire D.

Tools and machines	Tools and machines now being used	Tools and ma- chines desired
Wood and metal finishing		
Spray gun		
Baking oven		
Special finishes		
Spray booth		
Wood turning		
One speed lathes		
Variable speed lathes		
How many?		
Calipers		
Woodworking		
Necessary hand tools		
Table saws		
Band saws		
Jig saws		
Jointer		
Planer		
Shaper		
Belt sander		
Disk sander		
Welding		
AC machine		
DC machine		
Oxy-acetylene outfit		
Welding table		
Portable cart		
Arc welding booth		
Shields for arc welding		
Flux		
Forging		
Anvil		
Ball Pein hammer		
Tongs		

Questionnaire D (cont.)

Tools and machines	Tools and machines now being used	Tools and ma- chines desired
Forging (cont.)		
Steel rules		
Punches		
Cold chisel		
Auto mechanics		
Set of socket wrenches		
Set of slip-on wrenches		
Universal wrenches		
Wheel pullers		
Emery		
Machine vise		
Electric drill		
Chain hoist		
Power jack		
Set end wrenches		
Valve grinder		
12 point box wrenches		
Pliers		
Thickness gauges		
Set of crescent wrenches		
Bearing scrapers		
Battery charger		
Hydrometer		
Valve refacer		
Valve seat reamer		
Platinum files		
Files		
Pin punches		
Valve lifter		
Ring compressor		
Set of speed wrenches		
Electricity		
Volt meter		
Amp meter		
Electric bell		
Electric motor		
Push button		
Wire		
Metallurgy		
Five book library		
Drawing		
Flat tables		
Adjustable tables		

Questionnaire D (cont.)

Tools and machines	Tools and machines now being used	Tools and machines desired
Drawing (cont.)		
Slant top tables		
Stools		
T-square		
Drawing sets		
Triangles		
Machine tool work		
Drill press (single spindle up to 1")		
Planer 16" 6' bed		
Pick off gear		
Lathe 9" 12" 16"		
Taps		
Drills		
Dies		
Shaper		
Milling machine		
Sheet metal		
Assorted tin snips		
Hand groovers		
Rivet set		
Tinners rule		
Hand brakes		
Soldering coppers		
Small clamps		
Set of bench stakes		
Bar folder		
Forming rolls		
Combination turning machine		
Furnaces		
Concrete and cement		
Trowels		
Mixing box		
Mixing hoes		

Table 6 gives the information secured from 16 Kansas high schools in regard to their equipment.

Table 6. Shop equipment in 16 Kansas high schools.

Tools and machines	Tools and machines now in use	Tools and ma- chines desired
Wood and metal finishing		
Spray gun	8	1
Baking oven	0	1
Special finishes	1	0
Spray booth	3	6
Wood turning		
One speed lathes	1	1
Variable speed lathes	8	3
Calipers	9	0
Woodworking		
Necessary hand tools	9	1
Table saws	9	1
Band saws	8	1
Jig saws	4	5
Jointer	8	2
Planer	1	3
Shaper	6	3
Belt sander	6	1
Disk sander	2	1
Welding		
AC machine	1	4
DC machine	2	1
Oxy-acetylene outfit	4	2
Welding table	4	3
Portable cart	4	3
Arc welding booth	2	5
Shields for arc welding	2	5
Flux	3	1
Forging		
Anvil	9	0
Ball Pein hammer	9	0
Set of 3 tongs	9	0
Steel rules	9	1
Punches	9	0
Cold chisel	9	0
Auto mechanics		
Set of socket wrenches	6	1
Set of slip-on wrenches	5	0
Universal wrenches	4	1
Wheel pullers	2	3
Emery	6	0

Table 6 (cont.)

Tools and machines	Tools and machines now in use	Tools and ma- chines desired
Auto mechanics (cont.)		
Machine vise	6	0
Electric drill	4	2
Chain hoist	2	2
Power jack	0	2
Set end wrenches	5	1
Valve grinder	3	1
12 point box wrenches	4	1
Pliers	6	0
Thickness gauges	3	1
Set of crescent wrenches	7	0
Bearing scrapers	0	2
Battery charger	1	2
Hydrometer	1	3
Valve refacer	0	3
Valve seat reamer	0	3
Platinum files	5	3
Files	6	0
Pin punches	5	1
Valve lifter	1	4
Ring compressor	1	4
Set of speed wrenches	4	1
Electricity		
Volt meter	7	1
Amp meter	7	1
Electric bell	9	0
Electric motor	6	1
Push button	9	0
Wire	9	0
Metallurgy		
5 book library	2	2
Drawing		
Flat tables	5	0
Adjustable tables	2	2
Slant top tables	3	0
Stools	7	1
T-squares	10	0
Drawing sets	7	0
Triangles	8	0
Blue print machine	0	1
Machine tool work		
Drill press (single spindle up to 1")	8	2

Table 6 (concl.)

Tools and machines	Tools and machines now in use	Tools and ma- chines desired
Machine tool work (cont.)		
Planer 16" 6' bed		
Pick off gear	0	1
Lathe 9" 10" 12" 16"	4	4
Taps	5	3
Drills	8	0
Dies	5	2
Shaper	0	2
Milling machine	0	5
Sheet metal		
Assorted tin snips	9	1
Hand groovers	7	1
Rivet set	6	3
Tinners rule	1	2
Hand brakes	4	4
Soldering coppers	9	1
Small clamps	7	0
Set of bench stakes	4	3
Bar folder	5	5
Forming rolls	2	5
Combination turning machine	2	5
Furnaces	7	2
Concrete and cement		
Trowels	4	2
Mixing box	1	4
Mixing hoes	1	4

Table 6 shows a lack of equipment in the newer fields of welding, mechanics, and sheet metal. It will also be noted that there is a need for more machinery in all fields except forging.

Another interesting finding is the fact that wherever forging is being taught the shops are well equipped and do not need much added equipment.

CURRICULUM FOR A GENERAL SHOP FOR LYONS

This study indicates the need of a general shop in Lyons high school where the boys may have an opportunity to learn the skills of the different trades and industries. In this shop a boy will have an opportunity to choose the trade more nearly adapted to his likings and aptitudes. With this in view a curriculum in general shop has been drawn up for the four-year senior high school and the two-year junior high school of the city of Lyons. The average enrollment in the junior and senior high school is 470, and the average enrollment in industrial arts is 115 per day.

Drawing, with a class enrollment of 15, is taught as a separate course in this school and is not used as a unit in the general shop. The size of class that has been considered is 24 pupils. Lyons has three classes of this size and the survey shows 24 to be the preferred size.

Table 7. The general shop curriculum for Lyons High School.

Period	Length of period	Trades taught
1st	60 minutes	General Shop I
2nd	70 min. M. Tu.--50 min. W. Th. F.	General Shop I
3rd	65 min. M. Tu.--50 min. W. Th. F.	Mechanical Drawing
4th	60 minutes	Special skills
5th	50 minutes	7-8 Grade General Shop (required one semester)
6th	60 minutes	Special skills

*Activity period at this time on these days.

Units taught in general shop:

Woodwork	Welding
Woodturning	Mechanics
Electricity	Forging
Sheet metal	

In order that the general shop could be introduced into the Lyons High School, it is necessary to make maximum use of existing equipment and thereby remove the necessity of going to undue expense at present.

The units should be taught according to the following program of work: With a class of 24, 12 boys take woodwork (woodturning, refinishing, carpentry, and cabinet making) the first semester or 18 weeks, while the other 12 boys divide their time among the remaining five units. This arrangement gives each boy at least three weeks with each unit. Beginning the second semester these groups exchange places.

Following a year's course in general shop a boy may elect a course in special skills. The purpose of this course is to enable the boy to further develop those skills which were found to suit his needs best.

Seventh and eighth grade general shop is the same as General Shop I only on an elementary basis.

PROPOSED EQUIPMENT AND ITS COST

The following list of tools and machines is essential to a well equipped general shop accomodating a class of 24 pupils, eight taking woodworking, two woodturning, two wood finishing,

two electric work, two oxy-acetylene welding, two electric welding, two sheet metal, two forging, and two auto mechanics.

The costs of tools and machines were taken from 1940 catalogues. The maker's name and catalogue number are given, not to advertise, but to give definite information on what is generally recognized as standard equipment.

Table 8. Equipment for general shops.

Quantity: Required:	Unit:	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
2	only	Hand saw	24" 11 pt.	\$ 2.50	\$ 5.00	Disston D 8, Atkins No. 53
2	only	Hand saw	24" 9 pt.	2.50	5.00	Disston D 8, Atkins No. 53
2	only	Rip saws	26" 8 pt.	2.85	5.70	Disston D 8, Atkins No. 53
8	only	Adze-eye bell- faced hammers	16 oz. less handle	1.00	8.00	Maydole No. 11½, Stanley No. 51½
8	only	Jack planes	14" with cutter	4.50	36.00	Stanley No. 5, Sargent No. 145
2	only	Block planes	6"	2.25	4.50	Stanley No. 18, Disston 208
1	only	Jointer plane	20"	8.00	8.00	Stanley No. 7C
1	only	Circular plane	10"	4.00	4.00	Stanley No. 113
1	only	Bullnose plane	4"	4.00	4.00	Stanley No. 75
8	only	Try squares	8" iron head	1.00	8.00	Stanley No. 120
4	only	Carpenters squares	16" x 24" steel	2.50	10.00	Disston No. 5½ Sargent 100C, Stanley 100C
2	only	Carpenters squares	8" x 12" steel	1.50	3.00	Sargent 100C, Stanley 100C
4	only	Marking gauges	6"	.35	1.40	Stanley No. 65, Disston 80½
8	only	Benches	:Single	50.00	400.00	W. D. Allen No. 5501BB (No. 30)
3	sets	Wood chisel	: 1", 1½", 3¼", 1"	2.50	7.50	Stanley Everlast- ing, Sargent VBM No. 121
2	only	Draw knives	: 9" blade	1.50	3.00	Townley 20-9

Table 8. (cont.)

Quantity Required	Unit	Name of tool	Size and description	Cost of: each	Total cost	Recommended qual- ity and finish equal to--
6	only	Scrapers	Hand 3" x 5"	\$.30	\$ 1.80	Townley No. 22
2	only	T-bevel	6" blade	1.00	2.00	Stanley No. 18
3	only	Ratchet braces	10" sweep	4.00	12.00	Russel Jennings No. 40, Stanley No. 811
2	only	Automatic drills		3.00	6.00	Yankee No. 44, Millers Falls No. 180
2	sets	Auger bits	$\frac{1}{4}$ " to 1" by sixteenths	7.50	15.00	Russell Jennings, Irwin
1	only	Expansive bit	2 cutters $\frac{7}{8}$ " to $1\frac{1}{2}$ "	2.20	2.20	Russell Jennings No. 71, Millers Falls No. 48
2	only	Forstner bits	$\frac{1}{4}$ ", $\frac{1}{2}$ "	1.00	2.00	Stanley
1	only	Countersink for wood	Rose head 4" 82*	.50	.50	Stanley No. 20
2	only	Screwdriver bits	3/8" x 5"	.20	.40	Stanley No. 26
1	only	Bit gauge		.50	.50	Sargent No. 13 Millers Falls No. 1
6	only	Screw drivers	6"	.25	1.50	Stanley (Hurwood) No. 20
2	only	Screw drivers	4"	.20	.40	Champion No. 5 Stanley (Hurwood) No. 20
2	only	Screw drivers	3"	.50	1.00	Champion No. 4 Stanley (Hurwood) No. 20
						Champion No. 3

Table 8 (cont.)

Quantity: Required	Unit	Name of tool	Size and description	Cost of: each	Total cost	Recommended qual- ity and finish equal to--
2	: only	: Screw drivers	: 12"	: \$.50	: \$ 1.00	: Stanley (Hirwood) No. 20
2	: only	: Nail set	: 3/32"	: .25	: .50	: Champion No. 10 Goodell-Pratt No. 347, Millers
10	: only	: Bar clamps	: 5 each 32", 48"	: 2.50	: 25.00	: Falls No. 453 Taylor No. 25, Har grave Regular Pattern
10	: only	: Handcrew clamps	: 5 each 8" and 10" opening	: 2.50	: 25.00	: Jorgensen
4	: only	: Carriage clamps	: 2 each 8" and 10" opening	: 2.00	: 8.00	: Hardgrave No. 18- 20
2	: only	: Wing dividers	: 8"	: 1.50	: 3.00	: Starrett No. 92 Peck, Stow and Wilcox No. 9
2	: only	: Oilstone	: 1" x 2" x 6"	: 1.25	: 2.50	: Norton's India No. 138, Carborundum Co. No. 156
2	: only	: Saw set	: For handsaws	: 1.75	: 3.50	: Disston No. 28, Morrell Special, Stanley No. 42
1	: only	: Saw clamp	: 12"	: 1.00	: 1.00	: Disston
8	: only	: Saw files	: 5 1/4" slim taper	: .25	: 2.00	: Disston, Nicholson
1	: only	: Spray gun	: Electric with compression	: 50.00	: 50.00	: Presto No. 84
1	: only	: Spray booth				: Made in shop
2	: only	: Variable Speed lathes	: 12" x 43"	: 150.00	: 300.00	: Oliver

Table 8 (cont.)

Quantity: required:	Unit	Name of tool	Size and description	Cost of: each	Total cost	Recommended qual- ity and finish equal to--
4	: only	: Caliper	: Solid nut, 2 inside, 5", 2 outside 5"	: 1.20	: \$ 4.80	: L. S. Starrett No. 79-3 and 73-6
1	: only	: Table saw	: 8"	: 60.00	: 60.00	: J. D. Wallace
1	: only	: Band saw	: 16"	: 100.00	: 100.00	: J. D. Wallace
1	: only	: Jig saw	: 24" throat	: 35.00	: 35.00	: Walker-Turner
1	: only	: Jointer	: 6"	: 75.00	: 75.00	: Oliver
1	: only	: Mitre box and saw	: 4" x 18" saw	: 15.00	: 15.00	: Goodell-Pratt Co. No. 1118
1	: only	: Planer	: 20"	: 200.00	: 200.00	: Oliver
1	: only	: Shaper		: 50.00	: 50.00	: J. D. Wallace
1	: only	: Belt sander	: 4"	: 100.00	: 100.00	: Walker Turner "Take about"
		: Finishes		: 20.00	: 20.00	: Cooks
			: Sheet Metal			
4	: only	: Cold chisels	: 3/4" x 7 1/2"	: .70	: 2.80	: Vlchek
2	: only	: Cold chisels	: 1/2" x 5 3/4"	: .35	: .70	: Vlchek
2	: only	: Machinist's vise	: No. 4	: 13.60	: 27.20	: Parkers Eclipse No. 204, Reed No. 104
1	: only	: Gas furnace	: Direct jet	: 8.00	: 8.00	: Johnsons

Table 8 (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
1	set	Drills for metal	1/16" to 1/2" straight shank	\$ 12.50	\$ 12.50	Cleveland Twist Drill Co., Morse
3	only	Twist Drill for metal	9/16", 5/8", 3/4", 1/2" straight shank	1.75	5.25	Cleveland Twist Drill Co., Morse
24	only	Hack saw blades	12- 10" - 24 tooth	2.00	2.00	Starrett or Star
1	only	Hack saw	12- 10" - 14 tooth Adjustable	3.25	3.25	Millers Falls No. 1011, Universal No. 12
1	only	Combination pliers	8"	1.00	1.00	Utica No. 4000 Crescent
2	only	Combination pliers	6 1/2"	1.80	3.60	Utica No. 4000 Crescent
1	only	Side cutting pliers	8"	1.50	1.50	Crescent No. 50
2	only	Monkey wrenches	10"	1.85	1.85	Coe's Knife
2	only	Pipe wrenches	15"	3.25	3.25	Handle
2	only	Mill files	10"	2.85	2.85	Stillson Steel
2	only	Mill files	18"	5.50	8.34	Handle--Trimo
2	only	Mill files	Single cut, smooth 8"	.55	1.10	Disston, or Nicholson
2	only	Mill files	Single cut smooth 10", 12"	.80	1.60	Disston, or Nicholson
3	only	Round files	Second cut 6", 10", 12"	.60	1.80	Disston, or Nicholson
1	only	Square file	10"	.90	.90	Disston, or Nicholson

Table 8 (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
4	only	Soldering copper	1 lb. each	.40	1.60	Turner
1	only	Trimmer's snips	pointed pattern 3" blade	2.75	2.75	Miss No. 9 or Peck, Stow and Wilcox No. 9
2	only	Putty knife	1-3/8" blade	.40	.80	
1	only	Babbitt ladle	4"	.50	.50	
1	set	Hand groovers		1.50	1.50	Niagara or Pexto
1	set	Rivet set		.50	.50	Niagara or Pexto
1	only	Hand brake	12" blade	6.00	6.00	Niagara or Pexto
1	set	Bench stakes	Wrought iron	6.00	6.00	Pexto
1	only	Bar folder	36"	150.00	150.00	Niagara No. 4
1	only	Forming rolls	36"	100.00	100.00	Niagara No. 331
1	only	Combination turn- ing machine	Capacity 22 gauge	67.50	67.50	Niagara No. 185
Forging						
1	only	Anvil	125 to 150 lbs.	25.00	25.00	Hay-Budden, Trenton or Peter Wright
1	only	Forge	Hand with hood	37.50	37.50	Buffalo No. 7354
1	only	Vise	4" jaw, 100 lb.	25.00	25.00	

Table 8 (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
1	only	Hardie	To fit anvil	\$.50	\$.50	Atha Tool Co.
1	only	Bolt tongs	18", for 3/8" bolt	1.00	1.00	Vaughn & Bush- nell No. 11A
1	only	Farrier's tongs	16"	1.00	1.00	Atha Tool Co. 12A Vaughn & Bush- nell No. 12
2	only	General forging tongs	22"	.75	1.50	Vaughn & Bush- nell No. 12
2	only	Blacksmith's hammers	24 oz. less handle	1.00	2.00	Atha Tool Co. Vaughn & Bush- nell No. 12
2	only	Blacksmith's hammers	20 oz. less handle	1.00	2.00	Atha Tool Co. Vaughn & Bush- nell No. 12
2	only	Punches	9"	.50	1.00	Plumb or May- dole
2	only	Cold chisels	8"	.40	.80	Plumb or May- dole
Welding						
1	only	AC machine	150 amps	150.00	150.00	Atha Tool Co.
5	lbs.	Welding rod	1/8" Lincoln No. 7	1.00	5.00	Lincoln Electric Co.
1	only	Oxy-acetylene outfit		125.00	125.00	Linde Air

Table 8 (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of: each	Total cost	Recommended qual- ity and finish equal to--
10	lbs.	Oxy-acetylene rods	Steel 1/16", 1/8", 3/16"	.25	2.50	Linde Air
2	lbs.	Oxy-acetylene rods	Bronze 1/16", 1/8"	.50	1.00	Linde Air
1	only	Welding table				Made in shop
1	only	Portable cart				Made in shop
1	only	Arc welding booth				Made in shop
1	only	Plux for Oxy- acetylene	For bronze	1.00		
2	only	Shields for arc welding	1 head 1 hand	6.00 3.25		1.00: Linde Air 6.00: Lincoln 3.25: Lincoln
Electricity						
1	only	Volt meter	110 volts	8.00		8.00: Triplet Elec- tric Co.
1	only	Amp meter	110 volts	8.00		8.00: Triplet Elec- tric Co.
1	only	Electric bell	Door bell	.35		.35: General Electric
1	only	Electric motor	1/4 horse power 110 volts	10.00		10.00: Westinghouse
2	only	Push buttons	2 1/2"	.15		.30: Westinghouse
100	feet	Copper wire	Gauge 14	3.90		3.90: Westinghouse
1	only	Switch	2 way	.50		.50: Westinghouse

Table 8. (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
1	only	Switch	3 way	\$.50	\$.50	Westinghouse
Auto Mechanics						
1	set	Socket wrenches	No. 45	5.00	5.00	Snap On- Blue Point
1	set	Slip-on wrenches		5.00	5.00	Bonny
3	only	Universal wrenches	$\frac{1}{2}$ ", 9/16", 5/8"	.75	2.25	Bonny
1	set	Wheel pullers,	5/8", 3/4", 7/8", 1" 1 1/8"	2.00	2.00	Paeth, Townley or Thompson
1	only	Knock-out type Emery	Electric	50.00	50.00	Black and Decker
#1	only	Machine vise	2- 8" x 1 1/2" wheels			
#1	only	Drill				
1	only	Chain hoist	1 ton	18.50	18.50	Yale
2	only	Blacksmith's hammers	24 oz. less handle	1.00	2.00	Differential Atha Tool Co., Plumb or May- dole
2	only	Blacksmith's hammers	12 oz. less handle	.50	1.00	Atha Tool Co., Plumb or Maydole
1	only	Cotter pin puller	5/16"	.50	.50	Utica
2	only	Center punch	1/8", 7/32"	.25	.50	Brown & Sharp

Table 8 (cont.)

Quantity required	Unit	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
2	only	Pin punch	3/32", 3/8" points	.35	.70	Brown & Sharp
3	only	Crescent adjustable wrench	6", 10", 12"	1.25	3.70	Crescent
1	set	End wrench	Alloy steel (7/16- $\frac{1}{2}$) ($\frac{1}{2}$ -19/32) (9/16-5/8) (11/16-25/32) (3/4-13/16) (7/8-1) (31/32-1 1/16), (1 1/8-1 $\frac{1}{4}$)	10.00	10.00	J. H. Williams & Co., Rich-Con. or Faeth
*1	only	Outside caliper				
*1	only	Inside caliper				
1	only	Valve lifter	21"	1.00	1.00	Genuine Coes
1	set	Tappet wrench	6 wrenches	1.95	1.95	Bonny
1	set	Bearing scraper	Machinists, nonchattering	1.80	1.80	Faeth, Rich-Con.
1	only	Electric drill with stand	$\frac{1}{4}$ " special	50.00	50.00	Black & Decker U. S.
1	pair	Distributor pliers	4"	.50	.50	Bonny
1	set	12 point wrench	$\frac{1}{8}$ " to 1 1/8"	2.20	2.20	Bonny
1	only	Power jack	Jack weight 120 lbs.	35.00	35.00	Walker Roll-a-Car
1	only	Valve grinder	Hard	1.00	1.00	Stevens

Table 8 (concl.)

Quantity required:	Units	Name of tool	Size and description	Cost of each	Total cost	Recommended qual- ity and finish equal to--
1	: only:	Thickness gauge	9 leaves	\$ 1.50	\$ 1.50	Starrett 172A
3	: only:	Pliers	.0015 to .015			
		Button		1.00	3.00	Pexto No. 89
1	: only:	Battery charger	1 battery	18.00	18.00	Tungar Charger
1	: only:	Ring compressor	2 3/4" to 4 1/2"	1.50	1.50	Stevens
1	: only:	Valve refacer	110 volt	75.00	75.00	Van Norman
1	: only:	Valve seat reamer	Universal type	1.00	1.00	Van Norman
1	: only:	Hydrometer	Battery tester	.40	.40	Marvel
6	: only:	Speed wrench	7/16", 1/2", 9/16", 5/8", 7/8", 1"	6.00	6.00	Blackhawk
			Drawing			
8	: only:	Slant top table	Double			Made in shop
15	: only:	Stools	24"	1.00	15.00	Peabody Co.
	: sets:	Drawing set				Furnished by students
15	: only:	T-squares	24" hard wood edge	.50	7.50	Post
30	: only:	Triangle	6" 30-60-45	.28	8.40	Post
15	: only:	Drawing board	18" x 24"	.40	6.00	Made in shop
1	: only:	French curve	10"	.35	.35	Post
Total Cost				\$2,944.34		

* Previously listed

CONCLUSIONS

The data in this study furnish the evidence for the following conclusions:

1. Lyons has at least seven different trades employing not less than 100 tradesmen.
2. These tradesmen think that the high school should teach a larger number of skills than it is now teaching.
3. Mechanics and metal work rank first in importance.
4. The instructors in general shops in Kansas high schools think that the size of classes should be from 17 to 24 pupils.
5. Four to six units or skills may be taught during one period without impairing efficiency.
6. More equipment than is now in use is necessary in order to properly teach the skills.

It is planned to organize a shop that will fit the present needs of the Lyons High School and community. This plan might be used in other schools and communities by making the necessary adaptations. Since the trend is toward more metal work, this plan is admittedly a bit unbalanced toward woodworking. Existing equipment is such that this is necessary at the present time. However, the boy has the opportunity during his junior and senior years to elect the special skills course which will enable him to develop further those skills which were found to suit his need best.

ACKNOWLEDGMENT

Indebtedness is acknowledged to Dr. E. L. Holton, Head of the Department of Education, for directing this study; to Professor W. W. Carlson, Head of the Department of Shop Practice, for advising on technical points; to Dr. J. E. Ackert, Dean of the Division of Graduate Study, for his aid in criticizing the manuscript; to the tradesmen of Lyons, and to the instructors of the 16 Kansas high schools from whom much worthwhile information was secured.

LITERATURE CITED

1. Bernbaum, Eliot.
A follow-up study of trade-industrial arts as an educational panacea. Indus. Arts and Vocat. Ed. Mag. 29:19 Jan. 1940.
2. Campion, Howard Arthur.
Industrial education a vital service to youth. Indus. Ed. Mag. 54:233-236. Nov. 1937.
3. Feuerstein, Arthur.
What has the depression done to industrial arts education? Indus. Ed. Mag. 39:173-177. Sept. 1937.
4. Friese, John F.
Philosophy of industrial arts for American education. Indus. Arts and Vocat. Ed. Mag. 29:1-5. Jan. 1940.
5. Judd, Dr. Charles A.
What is general education? Indus. Ed. Mag. 54:225-232. Nov. 1937.
6. Klehm, W. A.
Industrial arts and vocational education in the modern school. Indus. Arts and Vocat. Ed. Mag. 29:41-45. Feb. 1940.
7. Lush, C. K.
The multiple shop concept. Indus. Arts and Vocat. Ed. Mag. 29:85-87. March, 1940.
8. Moffett, F. J.
Industrial arts cooperates. Indus. Arts and Vocat. Ed. Mag. 29:5-8. Jan. 1940.
9. Reagh, Arthur L.
Trends influencing industrial education. Indus. Arts and Vocat. Ed. Mag. 29:189-192. May, 1940.
10. Schweickhard, Dean M.
Turning toward tomorrow. Indus. Arts and Vocat. Ed. Mag. 29:11. Jan. 1940.
11. Trends in methods, organization and selection of subject matter for the general shop--a report. Indus. Ed. Mag. 56:37. Jan. 1937.

APPENDIX

Questionnaire A

Mr. Contractor A:

It is our desire to have some information concerning the trades in the city of Lyons, in order to organize a curriculum in your high school which will enable the boys of Lyons to become better citizens by being able to find the work to which they are best fitted.

If you will answer the following questions it will be appreciated very much. The information will be kept confidential.

How many men do you employ?

How long is their working day?

How many working days do they have each year?

What is their average salary?

Questionnaire B

Mr. Tradesman:

Here is a list of industrial arts units that may be taught in an up-to-date general shop. With your present knowledge as to your needs, which ones would you take if you were back in high school? Rank in order of preference--placing the number one after the one you think most important, two after the second in importance and so on.

Wood and Metal Finishing
Wood Turning
Carpentry
Cabinet Making
Woodworking
Oxy-acetylene Welding
Electric Welding
Sheet Metal
Forging
Concrete and Cement
Auto Mechanics
Electricity
Metallurgy (study of metals)
Machine Tool Work
Mechanical Drawing
Other Suggestions

Thanks,
J. W. Truax

Questionnaire C

Dear Instructor:

I am making a study of the general shop programs in high schools with an enrollment of 300 to 400 students. I shall use the information in the organization of a general shop for the Lyons, Kansas, High School.

Will you please follow instructions and fill out the following forms and return at your earliest convenience, to J. W. Truax, Lyons, Kansas?

For furnishing this information I shall be glad to give you a copy of my findings if you desire it.

Industrial arts units	Units now being taught	Units you think should be taught
Wood and Metal Finishing Woodturning Carpentry Cabinet Making Woodwork Oxy-acetylene Welding Electric Welding Sheet Metal Forging Concrete and Cement Auto Mechanics Electricity Metallurgy (study of metals) Machine Tool Work Mechanical Drawing Machine Drawing Other Suggestions		

How many shop units do you teach in one class period?
 How many would you like to teach in one period?
 How many students do you have per class?
 How many would you like to have?